Treatment Process

Pretreatment Filtration System

The pretreatment filtration system was previously used in a DWR seawater-desalting project at William R. Hearst State Beach Park in San Simeon. The media filtration system consisted of four 36-inch diameter, 72- inch tall vertical fiberglass reinforced plastic (FRP) pressure vessels. An inlet baffle is provided inside the top opening of each vessel to deflect the water entering the tank. Slotted laterals are arranged around a central hub installed in the dished bottom of the vessel. The tops of the vessels are painted to decrease the effects of UV radiation. Each vessel weighs approximately 3,000 pounds when fully loaded with media.

Three of the four filters contain anthracite and garnet media and the fourth filter contains anthracite and sand media. The media for the garnet filters consists of:

- 14.5 inches (500 pounds) of anthracite coal (size 0.8 mm to 1.0 mm) on top;
- Of 12.5 inches (1100 pounds) of #50 mesh garnet;
- Supported by 3 inches (300 pounds) of #8 mesh garnet;
- On top of 11 inches (650 pounds) of pea gravel.

The anthracite/sand filter was arranged somewhat differently, with only three layers of media:

- 14.5 inches (500 pounds) of anthracite working media;
- On top of 15.5 inches (1400 pounds) of fine sand;
- Supported by 11 inches (650 pounds) of pea gravel.

Sketches of the filters are shown in **Figure 7, Garnet and Sand Filters**.

In order to obtain the desired RO feed water quality it was necessary to add coagulant (alum [aluminum sulfate]) to the filter feedwater. The addition of coagulant helped the suspended solids in the feed water to agglomerate, which makes them easier to filter out.

A chemical injection facility was provided to add coagulant to the feed water. Alum was chosen for the coagulant due to its widespread use and availability.

The alum was held in a 55-gallon drum prior to injection and fed into the influent water by a solenoid-operated chemical injection pump at a rate of 0.18 gallons per day (gpd). This provided an alum concentration of 4 mg/L in the influent water.

The four filters were operated in two separate trains consisting of two filters each. Each train was capable of supplying the necessary feed water flow to the RO plant. At 20 gpm (design feed water flow to the RO) filter surface loading was 2.8 gpm/ft^2 . With both filter trains running, filter loading would have been 1.4 gpm/ft^2. However, the system was never operated with both trains running.

Filter Train #1 consisted of two garnet filters connected in series, while Filter Train #2 consisted of one garnet filter followed by a sand filter connected in series.

The filters were installed in a manner to allow backwashing of either of the two filter trains without taking the other train offline. RO permeate was used to backwash the filters. The backwash water was stored in a 2250-gallon tank. The backwash flow rate was approximately 60 gpm.

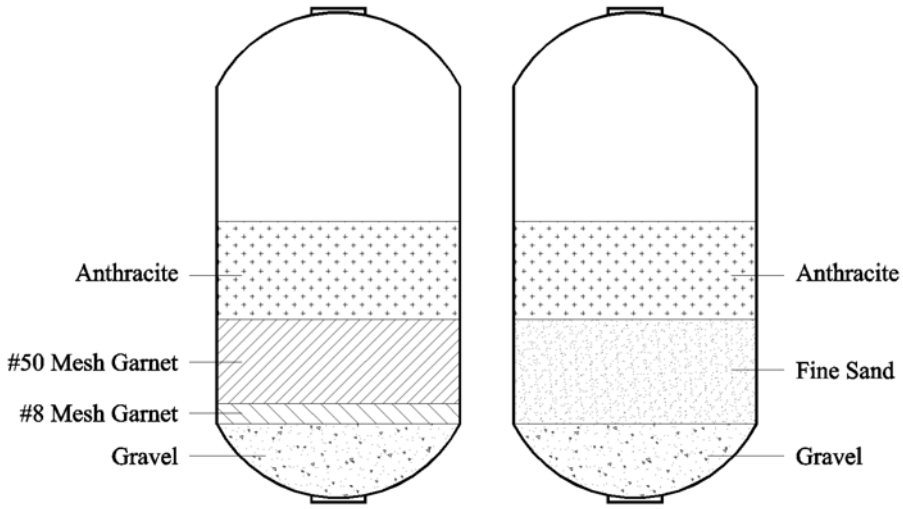


Figure 7: Garnet and Sand Filters

Reverse Osmosis System

The RO treatment system was trailer mounted and had a nominal permeate capacity of 16 gpm. It was equipped with a cartridge filter, boost and high-pressure pumps, monitoring instrumentation, and an automatic control system. The automatic control was connected to a computer that logged RO performance data. A flow diagram describing the demonstration unit is provided in **Figure 8**.

RO membranes were enclosed in six, three-element, four-inch diameter pressure vessels, arranged in a 2:2:1:1 array. **Table 4** lists the membranes used in the pilot.

Table 4. RO Membranes & Manufacturers

Membrane Type	Manufacture	Stage	Date Installed
TFC High Rejection	KOCH	First	8/15/00
TFC Ultra Low Pressure	KOCH	Second	8/30/00

The RO feed water was treated with muriatic acid (HCl) and scale inhibitor prior to entering the membranes. Target feed water pH and target scale inhibitor injection rates were 6.7 and 4.6 mg/L, respectively. In order to meet these injection rates using the chemical injection pumps, it was necessary to dilute the chemicals with RO permeate.

An initial projection of RO performance was made using water analyses sampled from nearby Well 38. The RO projection is provided in **Appendix C**. A mineral analysis of the water sampled from Well 38 is provided in **Table A.1** of **Appendix A** (under 1/6/00).

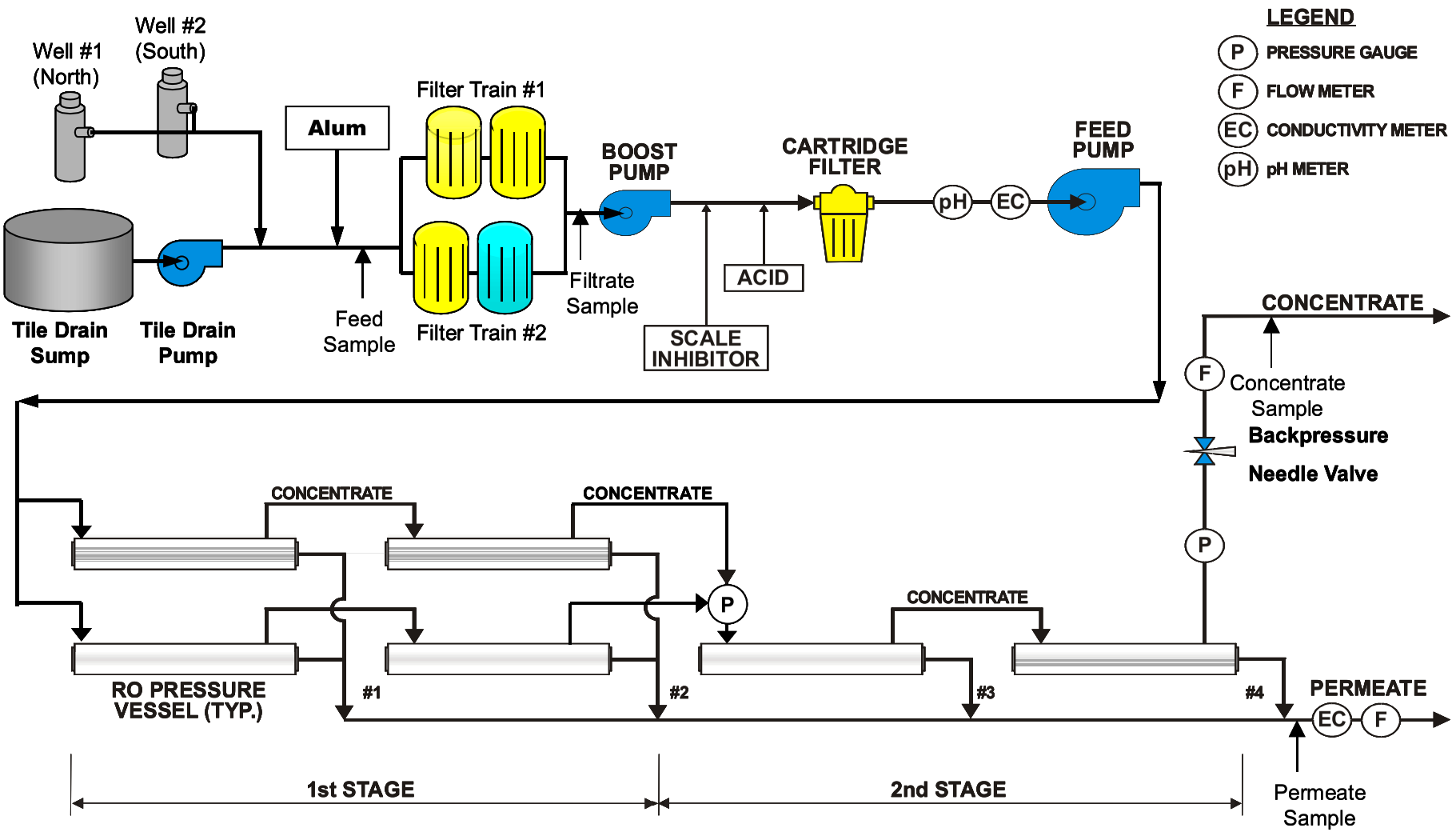
Daily Operator Tasks

The operators performed daily tasks as follows:

- Recorded and entered operating data into a computer spreadsheet. This data included the following: stream

flowrates, system and stream pressures, temperatures, turbidities, the SDI, and the RO feed.

- Checked filter pressure drop and backwashed the filter when necessary.
- Adjusted the RO permeate to correct the flowrate.
- Checked the cartridge filter pressure drop. Replaced the cartridges when necessary.
- Checked the chemical tank levels and replenished as required.
- Checked the chemical feed rates by calculating the amount pumped from the tanks. Adjusted if necessary.
- Checked the mechanical equipment. Called for service if required.



#1, #2, #3, and #4 are permeate sample points.

BOYLE Engineering Corporation

BUENA VISTA WATER STORAGE DISTRICT

FIGURE 8

DEMONSTRATION PLANT FLOW DIAGRAM

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